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SCIENTIFIC REFLECTIONS OF DIVING PHYSIOLOGY IN UNDERWATER-THEMED FILMS: A DESCRIPTIVE STUDY

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Abstract

Introduction: The desire to explore new places and gain different experiences has heightened interest in discovering the underwater world, leading to a diversification of aquatic recreational activities. Covering approximately 70% of the Earth's surface, the oceans and seas are home to a remarkable array of life, from microscopic unicellular organisms to colossal marine mammals.

Materials and Methods: Underwater-themed films were identified using the Internet Movie Database (IMDb) by searching for keywords such as "SCUBA diving," "free diving," "underwater," and "undersea." Films were selected based on their explicit or implicit depiction of underwater environments and diving physiology. Films with only brief underwater scenes or lacking physiological relevance were excluded.

Results: Underwater-themed films immerse viewers in mesmerizing and often perilous underwater realms. Iconic titles like *Jaws* underscore the threats posed by marine predators, while animations such as *Finding Nemo* highlight the vivid biodiversity of coral reefs. Films like *The Abyss* and *Leviathan* explore mysterious underwater life forms and humanity's psychological and physical challenges beneath the sea. Documentaries including *The Silent World* and *The Deepest Breath* offer a realistic portrayal of marine environments and the physiological demands of diving.

Conclusion: Films offer a valuable introduction to underwater physiology but provide only a surface-level understanding. While documentaries with scientific grounding convey important concepts such as barotrauma and decompression sickness effectively, the complexity of diving physiology demands formal scientific education. Thus, films should be viewed as complementary tools rather than primary sources of medical or physiological knowledge.

Keywords: *Underwater physiology, Freediving, SCUBA, Diving medicine, Cinema*

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SU ALTI TEMALI FİLMLERDE DALIŞ FİZYOLOJİSİNİN BİLİMSEL YANSIMALARI: TANIMLAYICI BİR ÇALIŞMA

Öz

Giriş: Yeni yerler keşfetme ve farklı deneyimler yaşama isteği, su altı dünyasını keşfetmeye olan ilgiyi artırmış ve suya dayalı rekreasyonel faaliyetlerin çeşitlenmesine yol açmıştır. Yeryüzünün yaklaşık %70'ini kaplayan okyanuslar ve denizler, mikroskobik tek hücreli organizmalardan devasa deniz memelilerine kadar olağanüstü bir yaşam çeşitliliğine ev sahipliği yapmaktadır.

Gereç ve Yöntemler: Su altı temalı filmler, İnternet Film Veritabanı üzerinden "SCUBA dalışı", "serbest dalış", "su altı" ve "deniz altı" gibi anahtar kelimelerle yapılan aramalarla belirlenmiştir. Filmler, su altı ortamlarının ve dalış fizyolojisinin açık ya da örtük biçimde betimlenmesine göre seçilmiştir. Yalnızca kısa su altı sahneleri içeren veya fizyolojik açıdan alakasız filmler çalışma dışı bırakılmıştır.

Bulgular: Su altı temalı filmler, izleyicileri büyüleyici ve çoğu zaman tehlikeli su altı dünyalarına sürükler. *Jaws* gibi ikonik yapımlar, deniz yırtıcılarının oluşturduğu tehditleri vurgularken, *Kayıp Balık Nemo* gibi animasyonlar mercan resiflerinin canlı biyolojik çeşitliliğini ön plana çıkarır. *The Abyss* ve *Leviathan* gibi filmler gizemli su altı yaşam formlarını ve insanın bu ortamlardaki psikolojik ve fiziksel sınavlarını ele alır. *The Silent World* ve *The Deepest Breath* gibi belgeseller ise deniz ortamlarını ve dalışın fizyolojik gerekliliklerini gerçekçi bir şekilde yansıtır.

Sonuç: Filmler, su altı fizyolojisine dair değerli bir giriş sağlasa da, yalnızca yüzeysel bir anlayış sunar. Bilimsel temele dayanan belgeseller barotravma ve dekompresyon hastalığı gibi önemli kavramları etkili biçimde aktarırken, dalış fizyolojisinin karmaşıklığı; kapsamlı bir bilimsel eğitim gerektirir. Çalışmamızın özgünlüğü, filmleri doğrudan bilgi kaynağı olarak değil, tıbbi ve fizyolojik konuların anlaşılmasını destekleyen tamamlayıcı görsel araçlar olarak konumlandırmasında yatmaktadır.

Anahtar Kelimeler: *Su altı fizyolojisi, Serbest dalış, Tüplü dalış, Dalış tıbbı, Sinema*

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Introduction

Underwater-themed films have long captivated audiences with their fusion of natural beauty, mystery, and danger.The depths of the ocean—often portrayed as both majestic and menacing—have intrigued filmmakers for decades, resulting in a wide range of films including documentaries, science fiction, adventure, animation, and horror. This genre diversity enables underwater-themed films to attract a broad spectrum of viewers, immersing them in both real and imagined subaquatic experiences. Beyond visual spectacle, these films also explore themes of human endurance, environmental adaptation, and the physiological principles that govern life below the sea surface (Kirby, 2013).

The ocean's enigmatic world has consistently inspired filmmakers, giving rise to numerous

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works that appeal to all age groups and aesthetic preferences. These films blend realism with fantasy, challenging the boundaries of human capability and offering cinematic insights into the ocean's mysteries.

Underwater films represent a compelling intersection of science and art, portraying diving physiology in ways that inform as well as entertain. Diving physiology examines the human body's response to environmental extremes such as pressure, gas exchange, and immersion. Many underwater-themed films dramatize the experiences of divers and marine researchers, revealing lesser-known aspects of the underwater realm. These narratives often emphasize the dangers of deep-sea exploration and the physiological constraints imposed by such environments (Ilardo & Nielsen, 2018).

A fundamental concept in diving physiology is the effect of pressure, which increases by approximately one atmosphere for every 10 meters of depth (Fitriasari et al., 2024). This rising pressure significantly affects gas dynamics in the body, particularly nitrogen absorption. As divers descend, nitrogen dissolves into tissues, and rapid ascent can result in bubble formation—leading to decompression sickness, a potentially fatal condition (Eichhorn & Leyk, 2015).

Nitrogen narcosis is another critical challenge portrayed in underwater films. This condition, resembling alcohol intoxication, typically occurs at depths around 30 meters. Symptoms such as confusion, poor judgment, and hallucinations can endanger divers. Underwater-themed films often dramatize this phenomenon, showcasing the mental and physical vulnerabilities of divers navigating deep-sea hazards (Rocco et al., 2019).

In addition to nitrogen narcosis, oxygen toxicity represents a major risk at great depths. Elevated oxygen levels can cause seizures, unconsciousness, and death. This danger is particularly relevant for professional divers, military personnel,and competitive free divers. Advances in breathing gas compositions, diving gear, and safety standards have been developed to address these hazards (Samson et al., 2024).

Through engaging narratives and visually striking cinematography, underwater films bridge the gap between scientific knowledge and public interest, stimulating curiosity about diving science and human adaptation. Although such films often exaggerate physiological effects for dramatic effect, they nonetheless introduce audiences to key concepts in diving medicine, encouraging further learning and awareness (Kirby, 2013).

The objective of this study is to investigate how underwater-themed films represent core principles of diving physiology and evaluate their effectiveness in conveying scientific understanding to the general public. The central research question is: To what extent do these films accurately depict the physiological realities of diving, including pressure effects and human adaptation to extreme underwater environments? Additionally, this study explores whether these films promote scientific literacy or reinforce misconceptions. By analyzing a curated selection of underwater-themed films from a scientific perspective, the study contributes to ongoing discussions in science communication and the role of cinema in informal education.

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Materials and Methods

This original descriptive study systematically analyzes how underwater physiology is portrayed in cinema, based on a structured selection process and thematic evaluation of relevant titles identified via the Internet Movie Database (IMDb). Keywords such as "SCUBA diving," "free diving," "underwater," and "undersea" were used to identify films prominently featuring underwater settings and diving-related physiological themes.

Films were included based on their explicit or implicit depiction of underwater environments and diving physiology. Exclusion criteria involved films with only brief underwater scenes or those lacking physiological relevance. The final selection comprised 15 films, representing diverse genres such as documentaries, science fiction, fantasy, adventure, action, drama, animation, and horror, and containing identifiable references to pressure physiology, environmental adaptation, or marine biology.

Each film was reviewed through descriptive thematic analysis, with attention to the scientific accuracy of physiological depictions, their educational value, and the degree of cinematic dramatization. Metadata were collected for each film, including director, screenwriters, lead actors, year of release, genre, and narrative style. Additionally, IMDb ratings, dominant themes, and representations of underwater physiology were assessed.

The analysis specifically focused on how accurately diving physiology was portrayed, addressing concepts like decompression sickness, nitrogen narcosis, oxygen toxicity, and the physiological impact of high-pressure environments. Furthermore, the study evaluated whether these portrayals contributed to improving public understanding of diving medicine or propagated scientific inaccuracies.

As this research involved only publicly available data and did not include human subjects or private information, ethical approval was not required. The research relies entirely on open-access film content from IMDb and contains no experimental procedures. This study was presented as an oral presentation at the 17th National Underwater and Hyperbaric Medicine Meeting in Istanbul between 19-20 October 2024.

Results

Underwater-themed films immerse audiences in breathtaking, yet often hazardous, aquatic worlds. These films typically explore themes such as adventure, survival, human endurance, and the enigmas of the deep sea. Whether rooted in realistic documentaries or speculative science fiction, they function both as entertainment and as tools for examining underwater physiology.

Documentaries serve as a vital conduit between scientific understanding and public awareness of marine ecosystems. They showcase the diverse biology of ocean depths, coral reef habitats, underwater cave systems, and extreme diving scenarios. Notable examples include *The Silent*

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World, 20,000 Leagues Under the Sea, The Deepest Breath, and *The Big Blue*—each offering unique insights into the challenges and marvels of the underwater realm.

The Silent World, directed by renowned oceanographer Jacques-Yves Cousteau, was one of the earliest color documentaries of the sea. While celebrating marine biodiversity—including whales, sharks, fish schools, and corals—the film also reflects outdated ecological attitudes, particularly in its depiction of shark hunting. Nevertheless, it underscores technological milestones in underwater exploration (Internet Movie Database, 2025a).

In 1943, Cousteau and Emile Gagnan transformed diving with the invention of the Aqua-Lung—a self-contained breathing apparatus that revolutionized underwater exploration (Olmstead, 2008).

20,000 Leagues Under the Sea (1954), adapted from Jules Verne's novel, was a pioneering sci-fi depiction of deep-sea adventure. Aboard the submarine *Nautilus*, Captain Nemo explores the ocean while theoretically maintaining internal pressure stability at depth. While speculative, the film anticipates discussions on life-support systems and the psychology of isolation, relevant to saturation diving and extended missions (Internet Movie Database, 2025b).

The Deepest Breath (2023) documents the physiological extremes of freediving, following record-holding athlete Alessia Zecchini and her safety diver Stephan Keenan (Internet Movie Database, 2025c). The film explores hypoxia and hypercapnia, along with the mammalian diving reflex, which triggers bradycardia and vasoconstriction to preserve oxygen (Aslan et al., 2021).

The Big Blue (1988) illustrates the psychological and physiological boundaries of apnea diving, including hypoxic trance states and nitrogen narcosis, where nitrogen acts as a narcotic under pressure. The film poetically juxtaposes human vulnerability and oceanic immensity (Internet Movie Database, 2025d).

Science fiction films such as *The Abyss* blend speculative narrative with scientific realism (Internet Movie Database, 2025e). It addresses Boyle's Law (pressure-volume relationship), decompression sickness, and Henry's Law (gas solubility under pressure). It also features experimental liquid breathing technology, which remains under research for high-pressure medical and diving applications (Anderson et al., 2022a; Edge & Wilmshurst, 2021; Edwards, 2010).

Leviathan explores the psychological toll of deep-sea isolation and the risks of biotechnological manipulation in confined environments, echoing challenges faced by astronauts (Internet Movie Database, 2025f).

Animated films like *Finding Nemo* educate young audiences about reef ecology and coral bleaching, stressing environmental fragility. Coral reefs cover only 1% of the ocean floor but support 25% of marine life. Bleaching occurs when heat stress disrupts coral-algae symbiosis (Internet Movie Database, 2025g).

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Chasing Coral uses underwater time-lapse cinematography to document reef degradation, highlighting the urgency of marine conservation (Internet Movie Database, 2025h).

Dramatic works such as *Last Breath* (2025) portray real-life hyperbaric emergencies, as diver Chris Lemons survives acute hypoxia, hypercapnia, bradycardia, and sensory disorientation during a saturation dive mishap. The film offers a rare clinical depiction of human physiological limits under pressure (Internet Movie Database, 2025i).

My Octopus Teacher presents inter-species bonding and ecological intelligence, revealing octopus behaviors such as camouflage, problem-solving, and predator evasion within kelp forests (Internet Movie Database, 2025j).

Hold Your Breath: The Ice Dive documents cold-water freediving under ice, emphasizing mammalian diving reflexes and hypothermia risks. Cold water accelerates heat loss, risking cardiac arrest. The film also discusses mental training, controlled breathing, and guide rope protocols for extreme dives (Internet Movie Database, 2025k).

Underwater merges horror with science fiction, following scientists in a deep-sea rig facing creatures at 11 km depth. The film addresses bioluminescent marine life, pressure adaptation, and the use of remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs) (Internet Movie Database, 2025l).

Jaws, a cinematic classic, amplifies public fear of sharks, portraying the great white (*Carcharodon carcharias*) as a threat (Internet Movie Database, 2025m). In reality, shark attacks are rare and ecologically misunderstood. Sharks are crucial apex predators that stabilize marine food chains. The film inadvertently contributed to harmful culling rather than conservation awareness (LeBusque & Litchfield, 2022).

Sanctum dramatizes the technical and environmental hazards of cave diving, including closed-circuit rebreathers, sidemount systems, and guide lines essential for navigation in confined, low-visibility caves (Internet Movie Database, 2025n). Cave ecosystems also feature troglomorphic species with adaptive sensory traits (Petráček et al., 2021).

Black Sea centers on psychological and physiological confinement aboard a submarine, reflecting real-world data on stress from prolonged submersion, social isolation, and limited space. It highlights pressure adaptation and submersible technologies used in modern exploration (Internet Movie Database, 2025o).

Overall, 15 films were examined and categorized by genre, scientific accuracy, and educational impact. Documentaries represented one-third (n = 5); science fiction and drama films constituted the majority (n = 6); horror/thrillers (n = 3); and animation (n = 1). At least one core physiological concept—such as decompression sickness, nitrogen narcosis, or hypothermia—was identified in 80% (n = 12) of the films.

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Decompression sickness was the most frequently depicted medical condition (n = 8; 53%). Based on thematic evaluation, six films were deemed highly educational, seven were moderately informative, and two contained minimal or misleading science.

These findings demonstrate that underwater films serve not only as artistic representations but also as informal educational tools—albeit with limitations—regarding diving physiology. A detailed summary of the reviewed films is presented in Table 1, including directors, writers, main cast, genre, release year, and IMDb ratings.

Table 1. The table includes 15 underwater-themed films with information on directors, writers, cast, genres, release years, and IMDb ratings.

Film Title	Director	Writer	Actors	Genre	Year	IMDb Rating
Finding Nemo	Andrew Stanton, Lee Unkrich	Andrew Stanton, Bob Peterson, David Reynolds	Albert Brooks, Ellen DeGeneres, Alexander Gould	Animation, Adventure	2003	8.2/10
Jaws	Steven Spielberg	Peter Benchley, Carl Gottlieb	Roy Scheider, Robert Shaw, Richard Dreyfuss	Horror, Drama	1975	8.1/10
My Octopus Teacher	Pippa Erlich, James Reed	Pippa Erlich, James Reed	Craig Foster, Tom Foster	Drama, Documentary	2020	8.1/10
Chasing Coral	Jeff Orlowski	Jeff Orlowski, Davis Coombe	Andrew Ackerman, Mark Eakin, Perry Goldring	Documentary, Environment	2017	8.0/10
The Deepest Breath	Laura McGann	Laura McGann	Alessia Zecchini, Stephan Keenan, Leigh Baker	Documentary, Adventure	2023	7.7/10
The Big Blue	Luc Besson	Luc Besson, Robert Garland, Marilyn Goldin	Jean-Marc Barr, Jean Reno, Rosanna Arquette	Drama Adventure	1988	7.5/10
The Abyss	James Cameron	James Cameron	Ed Harris, Mary Elizabeth Mastrantonio, Micheal Biehn	Science Fiction, Adventure	1989	7.5/10

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Film Title	Director	Writer	Actors	Genre	Year	IMDb Rating
20000 Leagues Under the Sea	Richard Fleischer	Earl Felton, Jules Verne	Kirk Douglas, James Mason, Paul Lukas	Adventure	1954	7.2/10
The Silent World	Jacques-Yves Cousteau, Louis Malle	Jacques-Yves Cousteau	Frederic Dumas, Albert Falco, Jacques-Yves Cousteau	Documentary, Adventure	1956	6.9/10
Last Breath	Alex Parkinson	Mitchell LaFortune, Alex Parkinson, David Brooks	Woody Harrelson, Simu Liu, Finn Cole	Drama Thriller	2025	6.6/10
Hold Your Breath: The Ice Dive	Ian Derry	-	Jean Charles Granjon, Maria Hellinger, Antero Joki	Drama, Documentary	2022	6.6/10
Black Sea	Kevin Macdonald	Dennis Kelly	Jude Law, Scoot McNairy, Ben Mendelsohn	Adventure, Drama	2014	6.4/10
Sanctum	Alister Grierson	John Garvin, Andrew Wight	Rhys Wakefield, Allison Cratchley, Christopher James Baker	Adventure, Drama	2011	5.9/10
Underwater	William Eubank	Brian Durffield, Adam Cozad	Kristen Stewart, Vincent Cassel, Mamoudou Athie	Horror, Science Fiction	2020	5.9/10
Leviathan	George P. Cosmatos	David Webb Peoples, Jeb Stuart	Peter Weller, Richard Crenna, Amanda Pays	Science Fiction, Adventure	1989	5.8/10

Discussion

This study underscores the pivotal role of cinema in shaping public perception of underwater environments and human physiological responses to extreme conditions. Films—particularly documentaries—serve not only as informative tools but also as gateways to marine science, visually translating the complexities of diving physiology and ecological systems into more accessible narratives.

By dramatizing conditions like decompression sickness, nitrogen narcosis, and oxygen toxicity, these films simplify and enhance viewer engagement with otherwise technical subjects. How-

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ever, this dramatic license can lead to misrepresentations if not counterbalanced by accurate scientific context. For instance, conditions such as nitrogen narcosis and decompression illness are often shown as sudden and catastrophic events, whereas in reality, they are gradual processes influenced by multiple physiological and environmental variables. To harness their full educational potential, such films should be accompanied by evidence-based resources that reinforce scientific accuracy and facilitate a deeper understanding of human adaptation in underwater settings (Pan, 2024).

Beyond their scientific themes, films like *The Abyss* and *The Deepest Breath* also promote marine conservation ethicsand highlight the importance of responsible exploration. By portraying cutting-edge technology, diver endurance, and environmental extremes, these films foster public appreciation for the ethical and technical complexities of deep-sea research (Fauville et al., 2024). This is especially relevant given the growing impact of deep-sea mining, climate change,and industrial activity on fragile marine ecosystems (Anderson et al., 2022b).

Cinematic storytelling can serve as a powerful driver of science education, making underwater physiology more engaging, relatable**,** and memorable for students and general audiences alike. The integration of such films into academic curricula has the potential to inspire future careers in marine sciences, enhance environmental awareness, and foster a more scientifically literate society. Nonetheless, educators must ensure that cinematic fascination is bridged with structured scientific training and inquiry.

In line with recent findings that highlight how documentaries improve science communication and audience retention (Gaunkar et al., 2022), this study positions underwater-themed films as valuable assets within an informal learning ecosystem. However, their use in educational environments must be strategically guided to prevent entertainment from distorting factual understanding.

Ultimately, while underwater films are effective tools for raising awareness and initiating interest, they should be incorporated into a broader framework of formal education, experiential training**,** and public outreach**.** This multidisciplinary approach ensures a more accurate and comprehensive understanding of underwater physiology and the interconnected challenges of the marine world.

Conclusion

Films serve as engaging and visually impactful platforms for introducing audiences to the fundamental principles of underwater physiology. They effectively convey core scientific concepts such as gas laws, pressure-induced physiological responses, and the extreme conditions of underwater environments.

In particular, science-based documentaries enhance educational impact by illustrating phenomena such as barotrauma, decompression sickness, nitrogen narcosis, and the mammalian diving

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reflex. However, despite their strengths in sparking interest, most films lack the scientific depth and rigor required for a comprehensive understanding of diving physiology.

Mastery of this multidisciplinary field demands formal academic education, including peer-reviewed research, structured coursework, hands-on training, and clinical or field experience. While films can inspire curiosity and offer an accessible entry point, they must be supplemented with credible scientific resources to ensure accuracy and meaningful learning.

Films may raise awareness and introduce basic principles, but they often fall short in delivering contextual explanations, scientific precision, and depth of content. Therefore, their use in educational environments should be supported by rigorous academic materials, expert analysis, and structured curriculum integration. Without such reinforcement, the risk remains that cinematic dramatization may perpetuate misconceptions rather than enhance understanding.

Accordingly, underwater films should be viewed as complementary visual tools rather than stand-alone educational resources.

Ultimately, their educational potential is maximized when integrated into broader frameworks of formal instruction, experiential learning, and science communication outreach. By merging the power of visual storytelling with structured scientific education, society can achieve a more accurate and holistic grasp of the physiological challenges and environmental significance of the underwater world.

Ethical Approval

This study does not include human participants or any sensitive data; it is merely an analysis of publicly available films. As the study is based solely on publicly available data provided by IMDb and does not involve any experimental procedures, ethical approval is not required.

Conflict of Interest

There is no personal and/or financial conflict of interest within the scope of the study.

Author Contribution Rate

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1.Designing the study
2.Collecting the data
3.Analysis and interpretation of the data
4.Writing the manuscript
5.Critical revision

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